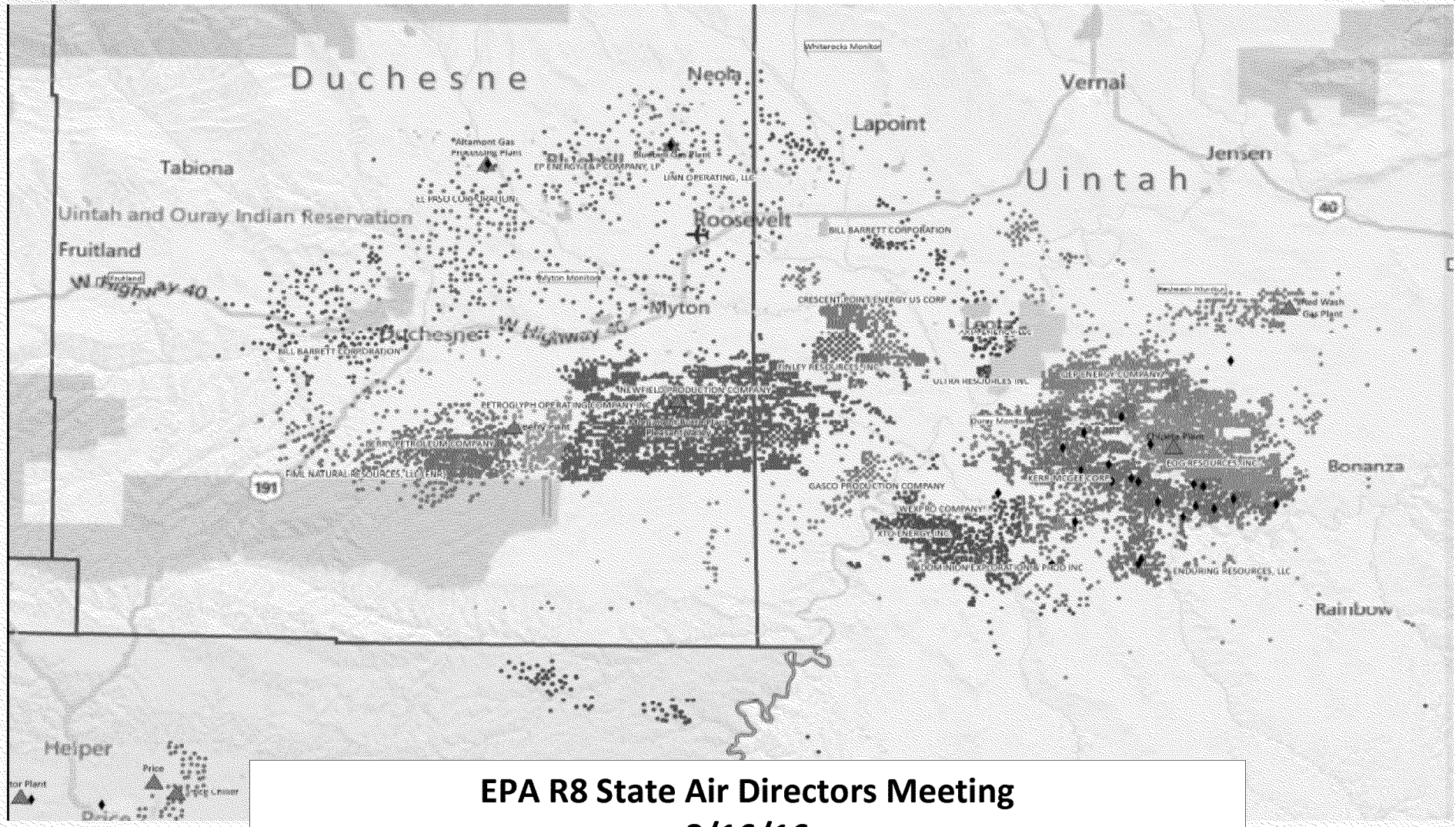
Uinta Basin Pneumatic Controller Research Project and Aerial IR Survey

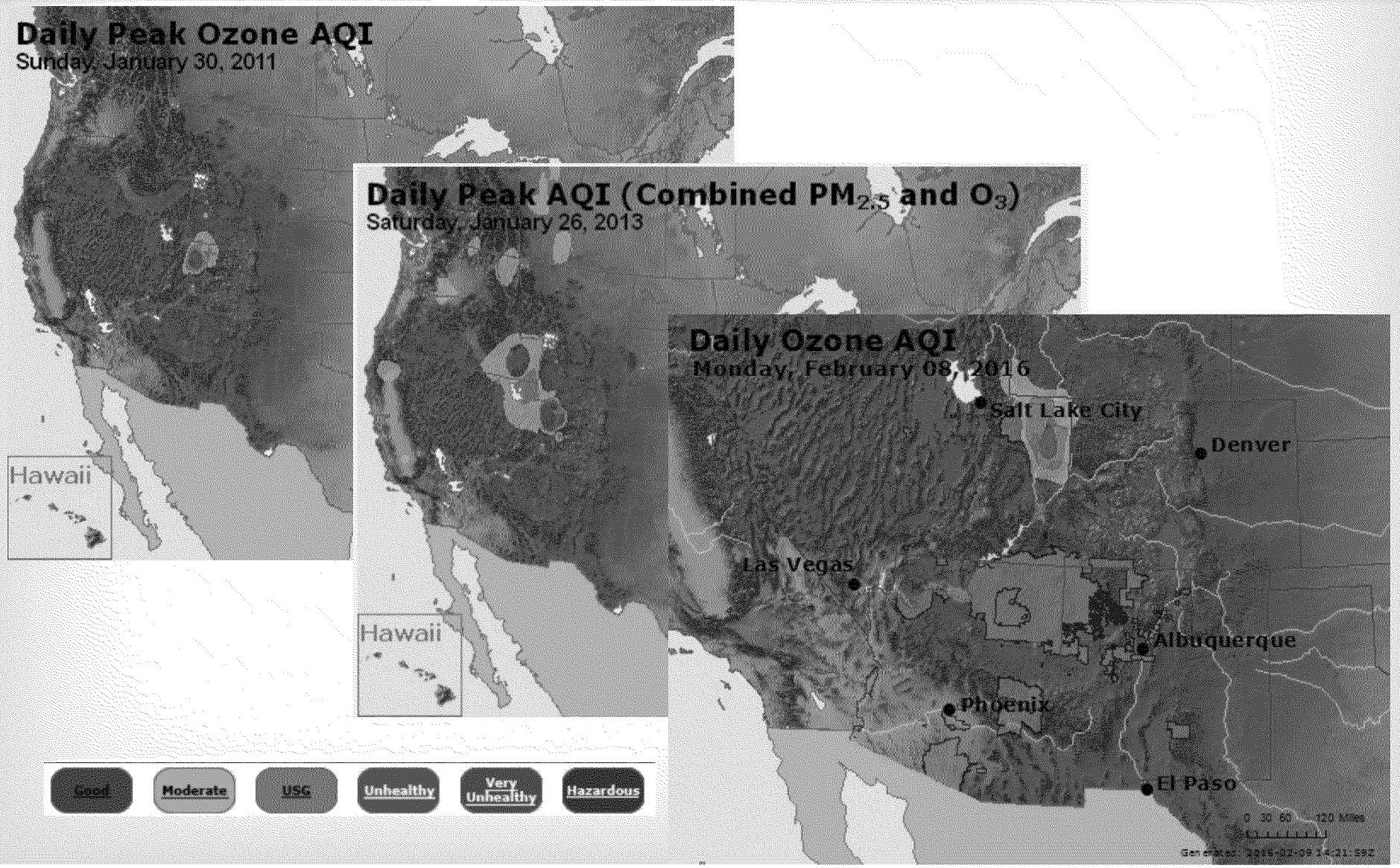


EPA R8 State Air Directors Meeting
8/16/16

Outline

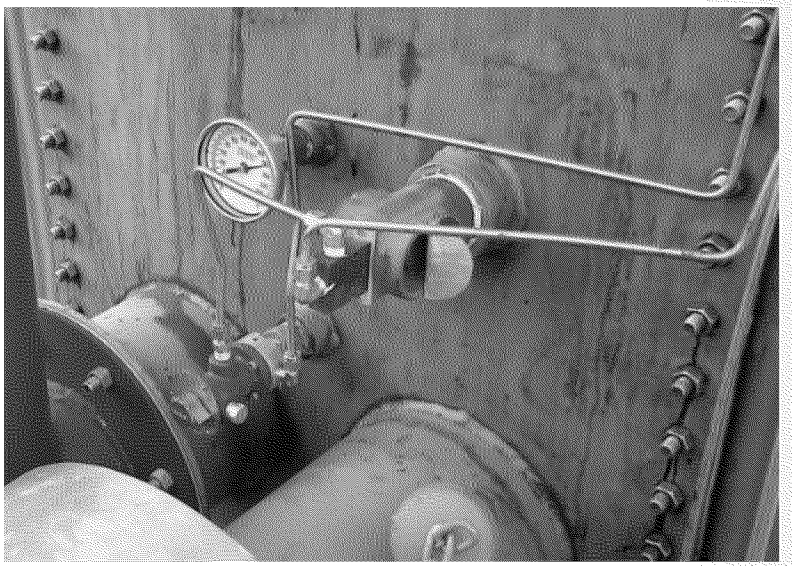
- Why Uinta Basin
- Overview of Pneumatic Controller Research project
- Overview of Aerial IR Survey project

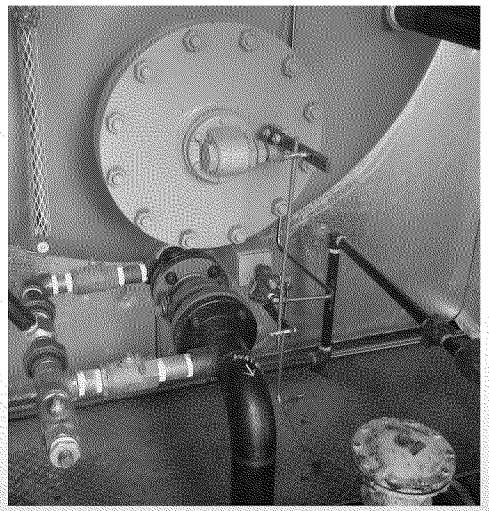
Why Uinta Basin?



PC Study

- Background
- Study Objectives
- Why Pneumatic Controllers
- What We Know So Far
- How This Study Helps





Background

- Groups Involved:
  - EPA - Office of Research and Development (ORD) and EPA Region 8
  - UDAQ - Utah Division Of Air Quality
  - Ute Tribe Air Program
  - BLM, Utah State Office, Vernal Field Office
  - EPA ORD contractor Jacobs Technology with subs (executing measurements)
  - Cooperating Uinta Operators
- Research Project funded by EPA (ORD)
  - ORD Regional Applied Research Effort (RARE), research needs of EPA Regions
  - ORD Air Climate and Energy Program (ACE)
- This is a research effort focusing on measurements and methods
  - Not part of any enforcement or compliance activity or other EPA program
  - Data acquired under ORD research-level quality assurance project plan

Study Objectives

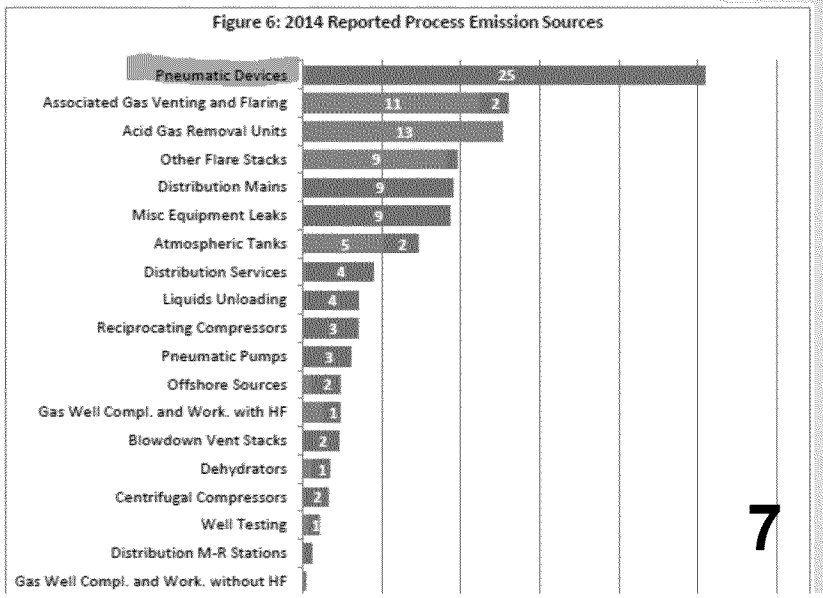
- Focus on pneumatic controllers (PCs) at wellpads
- Improve understanding of PC emissions
  - Is it a PC emission or fugitive/malfunction?
  - Understand intermittent PC operation
  - Acquire PC emission factor (EF) measurement data
- Advance PC activity factor (AF) information
  - Classifications and counts
  - Actuations
- Improve PC emissions measurement methods
- Contribute to Uinta Basin Emissions Inventory development
- Understand the impact of maintenance on PC emissions

Why Pneumatic Controllers?

- Large emission source
  - 3rd largest VOC contributor (after tanks and glycol dehydrators – WRAP III)
  - 1st largest methane contributor (GHGRP-W Onshore Production)
- Recent regulatory attention on PCs
  - NSPS OOOO requirements on low-bleed (<6 cfh) or no-bleed of gas
  - UDAQ pneumatic retrofit rule
  - BLM proposed "Waste Prevention, Production Subject to Royalty, and Resource Conservation"

WRAP Phase III Emission Inventory – Uinta Basin

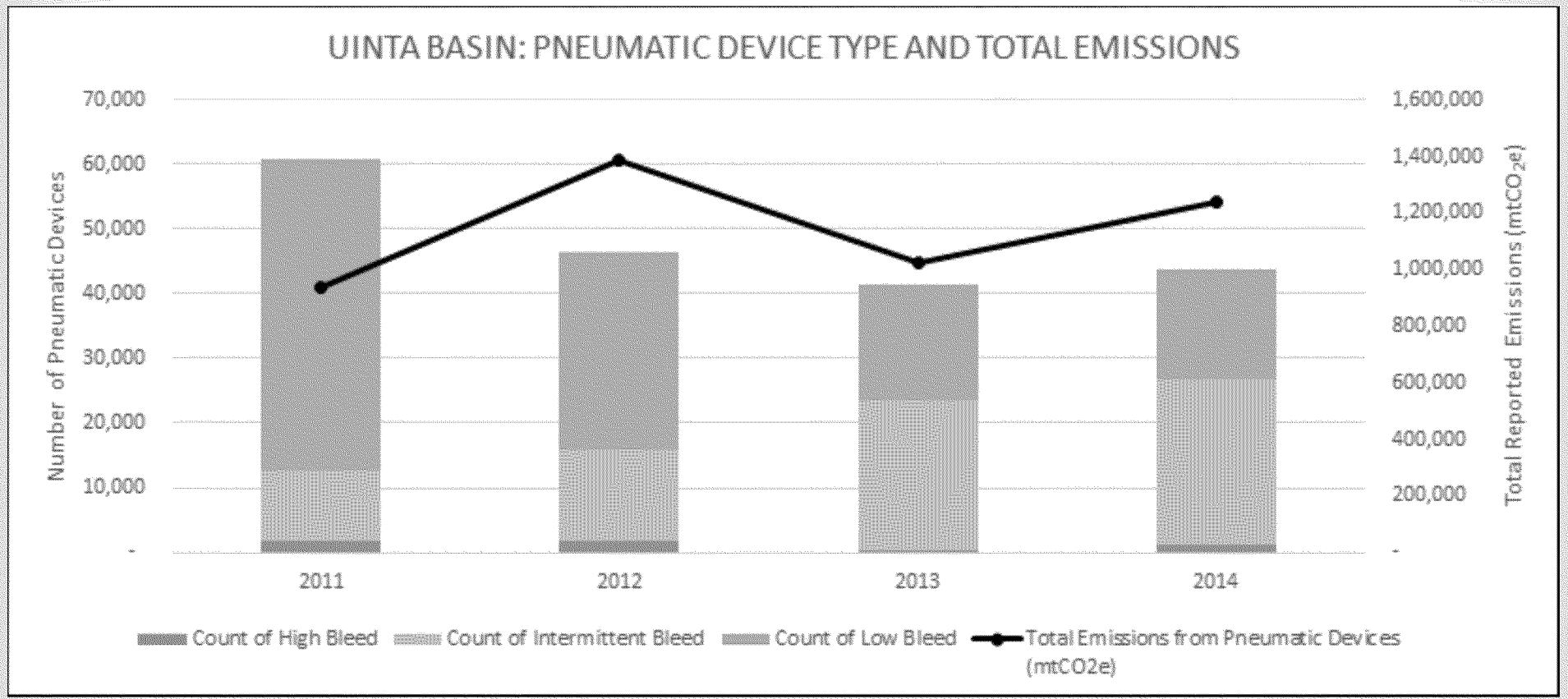
Description	2012 Emissions				
	NOx (tons/year)	VOC (tons/year)	CO (tons/year)	SOx (tons/year)	PM10 (tons/year)
Dehydrator	225	30,665	189	0	17
Pneumatic devices	0	25,083	0	0	0
Condensate tank	0	21,719	0	0	0
Oil Tank	0	20,722	0	0	0
Pneumatic pumps	0	14,322	0	0	0
Permitted Sources	3,184	4,355	2,517	8	48
Unpermitted Fugitives	0	3,212	0	0	0
Truck Loading of Oil	0	1,391	0	0	0
Venting - Compressor Startup	0	1,300	0	0	0
Venting - Compressor Shutdown	0	1,233	0	0	0
Artificial Lift	3,053	955	34,750	2	136
Compressor engines	3,169	695	4,236	0	46
Venting - blowdowns	0	460	0	0	0
Truck Loading of Condensate	0	445	0	0	0
Drill rigs	4,773	362	1,507	3	236
Venting - initial completions	0	332	0	0	0
Heaters	1,671	95	1,420	11	132
Miscellaneous engines	199	63	201	0	1
Venting - recompletions	0	51	0	0	0
Workover rigs	271	22	91	0	15
Gas Plant Truck Loading	0	12	0	0	0
Condensate tank flaring	2	0	9	0	0
Dehydrator Flaring	0	0	1	0	0
Initial completion Flaring	1	0	4	0	0
Total	16,547	127,495	44,925	24	631



What We Know So Far

EPA Greenhouse Gas Reporting Program – Subpart W

PC counts from GHGRP-W activity data led to increase in GHG Inventory for production PC emission estimate



What We Know So Far

- PC research to-date:
  - UT/EDF – Dave Allen et al – included a "Rocky Mtn Region" – SW WY, NE CO
  - OIPA – OK, counts, engineering calcs
  - Prasino – British Columbia, Alberta

- API Standard 4590, *Pneumatic Controllers*, currently underway
  - Proper classification – manufacturers, operators, regulators
  - Measurements

What We Know So Far

Emission Factors being used …

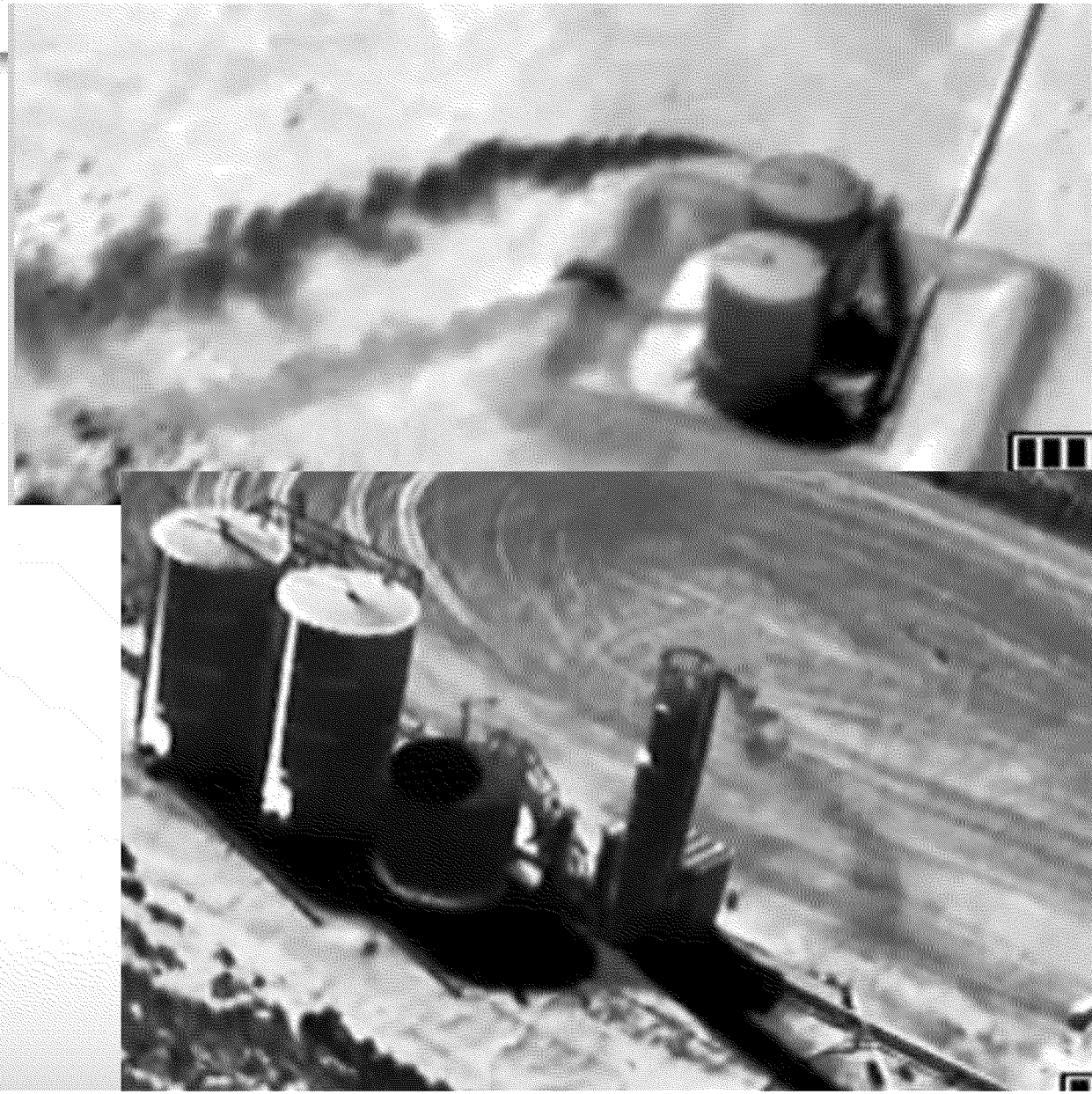
	Continuous–Low scf/device-hr	Continuous-High scf/device-hr	Intermittent scf/device-hr	Notes
CDPHE	0.14	12.4	1.72	UT/EDF Study – Rocky Mtn Region. Whole gas.
ODEQ - PCs	1.05 scf/device-hr			OIPA Study – engr calculations - Whole gas 3.6 devices/well
ODEQ - Fugitives	Avg. malfunction rate 50 scf/device-hr x 3% malfunction rate x 3.6 device/well x # wells			To account for malfunctions. Emission rate and Malfunc. rate per UT/EDF
GHGRP-W Western U.S.	1.39	37.3	13.5	Default whole gas factor

How This Study Helps

1) PC emission measurements in Uinta Basin
2) Forward discussion on what is and what is not a PC emission
3) Improve Uinta Basin activity counts (#PC/well, by function, type …)
4) Improve information on intermittent actuation frequency (to extent possible)
5) Improve site-specific gas composition knowledge
6) Understand PC malfunction frequency and repair factors
7) Advance measurement methods

Aerial IR Survey - *Potential*

- Background
- Study Objectives
- Why Aerial IR
- Precedence
- Project Plan



Background

- Groups Involved and Funding: - BLM - UT, EPA - Region 8, UDAQ
- UB Emission Inventory Workgroup – Phase I - VOC emissions ↓ compared to WRAP Ph. III
- Potential for U&O Reservation-specific FIP rulemaking for pre-NSPS OOOO sources
- NEPA evaluations
  - 5 Completed EIS/EA RODs include triggers and requirements for "Enhanced DI&M", but not-yet defined
  - EPA is currently a cooperating agency with BLM for EIS development for three projects to add thousands of O&G wells to UB – discussing mitigation options on existing sources
- UB Pneumatic Controller research project – fall 2016+ - bottom-up emission measurements

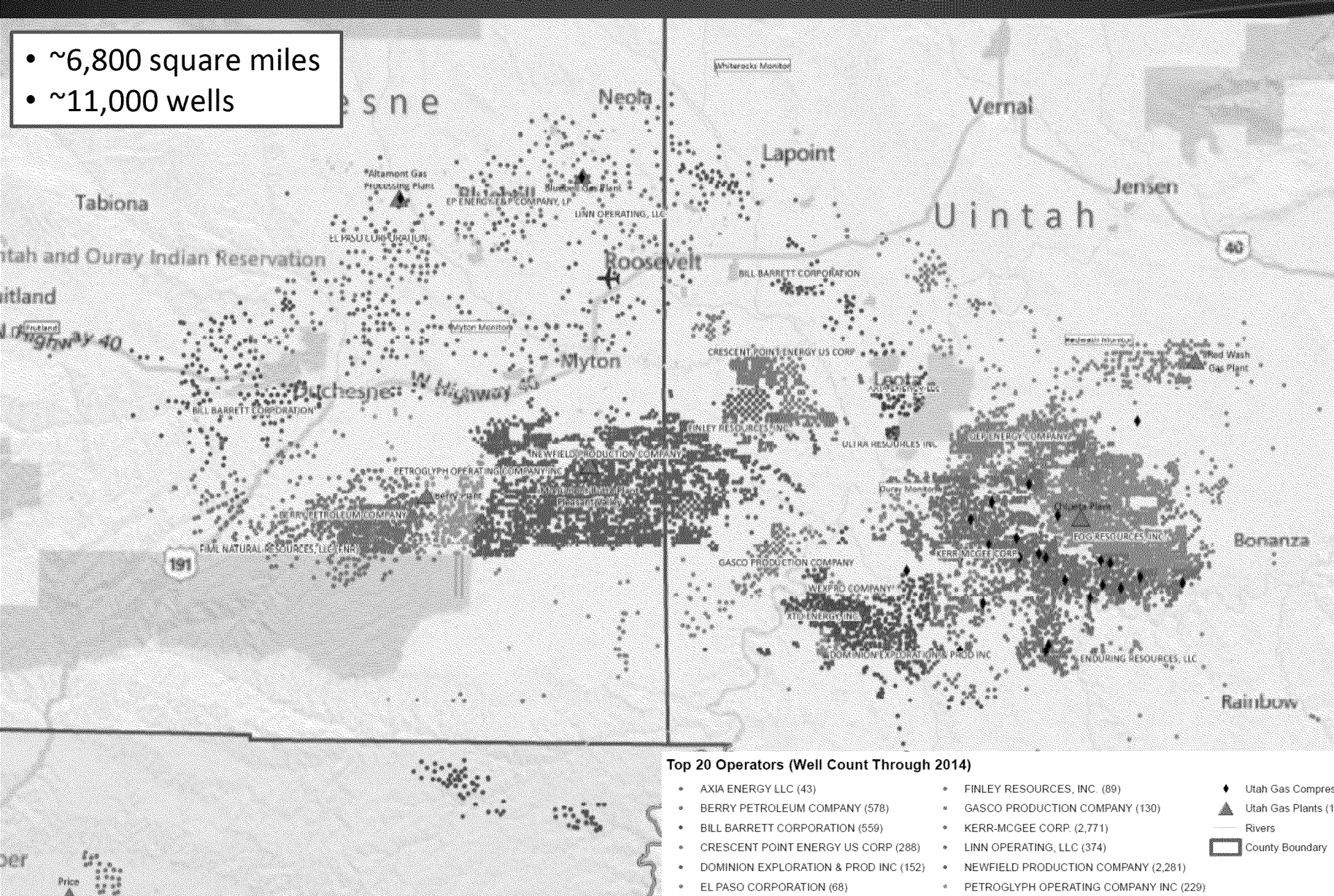
Study Objectives

- Through a collaborative effort of the BLM, EPA, Utah, Ute Tribe, and Operators:
  - **Find** large releases of hydrocarbon emissions from O&G operations in an efficient and cost effective manner
  - Identify cause of releases
  - **Fix** releases to reduce emissions and conserve gas prior to winter ozone season
- Inform emission inventory work on the frequency/probability of super-emitters
- Inform policy on mitigation options from characterization of super-emitters

Why Aerial IR Survey in UB

- Air quality challenges in UB
- Emission discrepancy: top-down vs. bottom-up
- Inform emission inventory work underway and future mitigation options
  - O&G emission inventories do not accurately account for super-emitters
  - EI → ozone model → policy decisions on mitigation
- Super emitters a challenge to find
  - Not fixed in time or space
  - Function of operation & maintenance
  - Many such emission sources not covered by CAA currently, so no reporting
  - Not a function of size of facility – UB predominantly small sources
- Reduce VOC emissions by timely identification of malfunctions and fixing them

- ~6,800 square miles
- ~11,000 wells



Top 20 Operators (Well Count Through 2014)

- AXIA ENERGY LLC (43)
- BERRY PETROLEUM COMPANY (578)
- BILL BARRETT CORPORATION (559)
- CRESCENT POINT ENERGY US CORP (288)
- DOMINION EXPLORATION & PROD INC (152)
- EL PASO CORPORATION (68)
- ENDURING RESOURCES, LLC (74)
- EOG RESOURCES, INC. (1,322)
- EP ENERGY E&P COMPANY, LP (262)
- FIML NATURAL RESOURCES, LLC (FNR) (45)
- FINLEY RESOURCES, INC. (89)
- GASCO PRODUCTION COMPANY (130)
- KERR-MCGEE CORP. (2,771)
- LINN OPERATING, LLC (374)
- NEWFIELD PRODUCTION COMPANY (2,281)
- PETROGLYPH OPERATING COMPANY INC (229)
- QEP ENERGY COMPANY (813)
- ULTRA RESOURCES INC (82)
- WEXPRO COMPANY (79)
- XTO ENERGY, INC. (416)

Utah Gas Compres
Utah Gas Plants (1
Rivers
County Boundary

Precedence of Aerial IR Surveys in O&G

- TCEQ - 16 campaigns since 2005
- R6 - 5 campaigns in 2012-2013

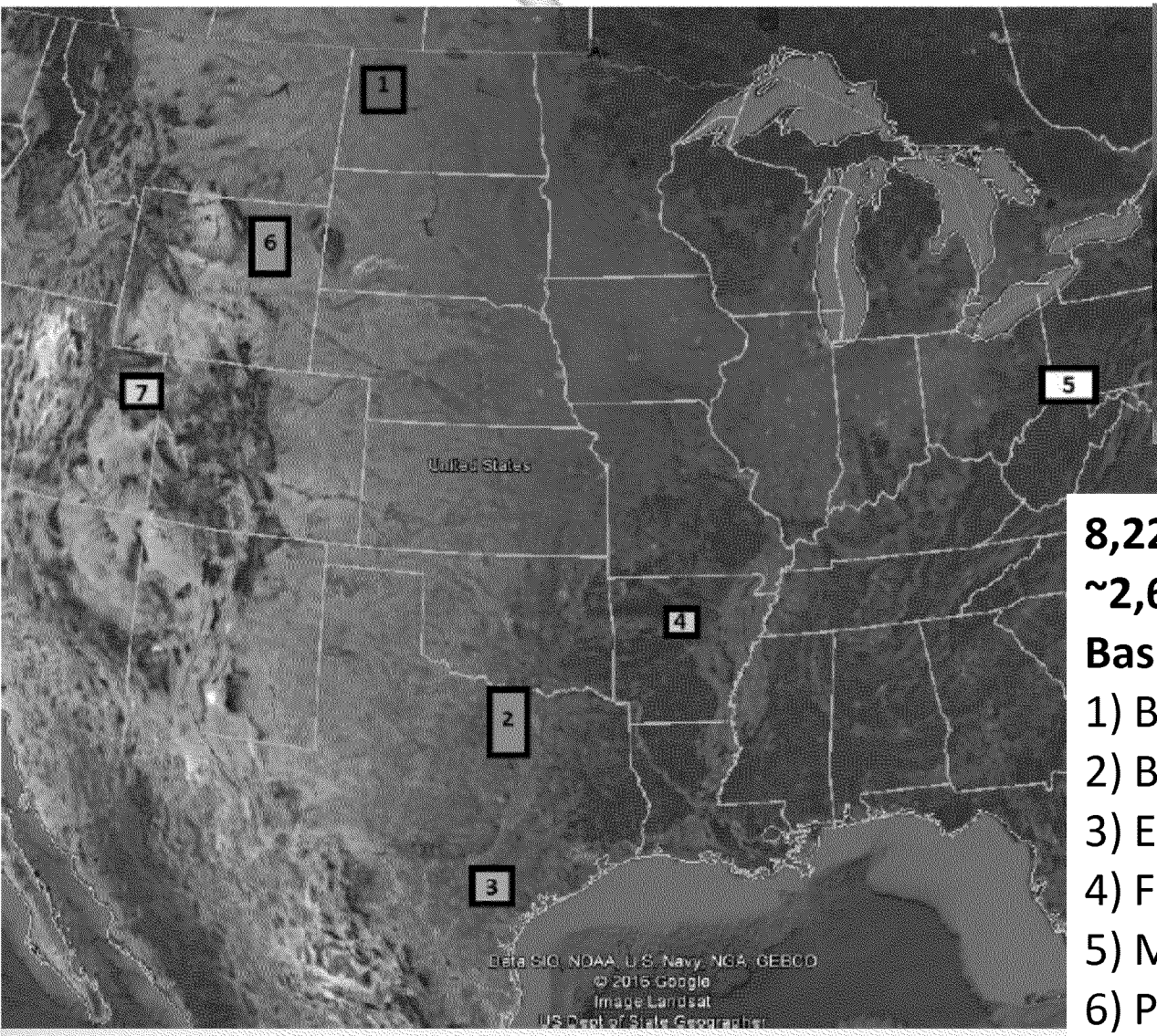
~ 5-10% of facilities had continuous leaks, unintentional gas carry through, or unpermitted releases

- EDF Aerial IR Surveys of 7 basins

1%-14% of facilities w/ overserved HC emissions 6.6% in UB

- LSI contractor - has conducted dozens of flyover campaigns for TCEQ, EPA Regions 6 & 4, Industry and researchers (EDF study) in many different basins across the U.S.

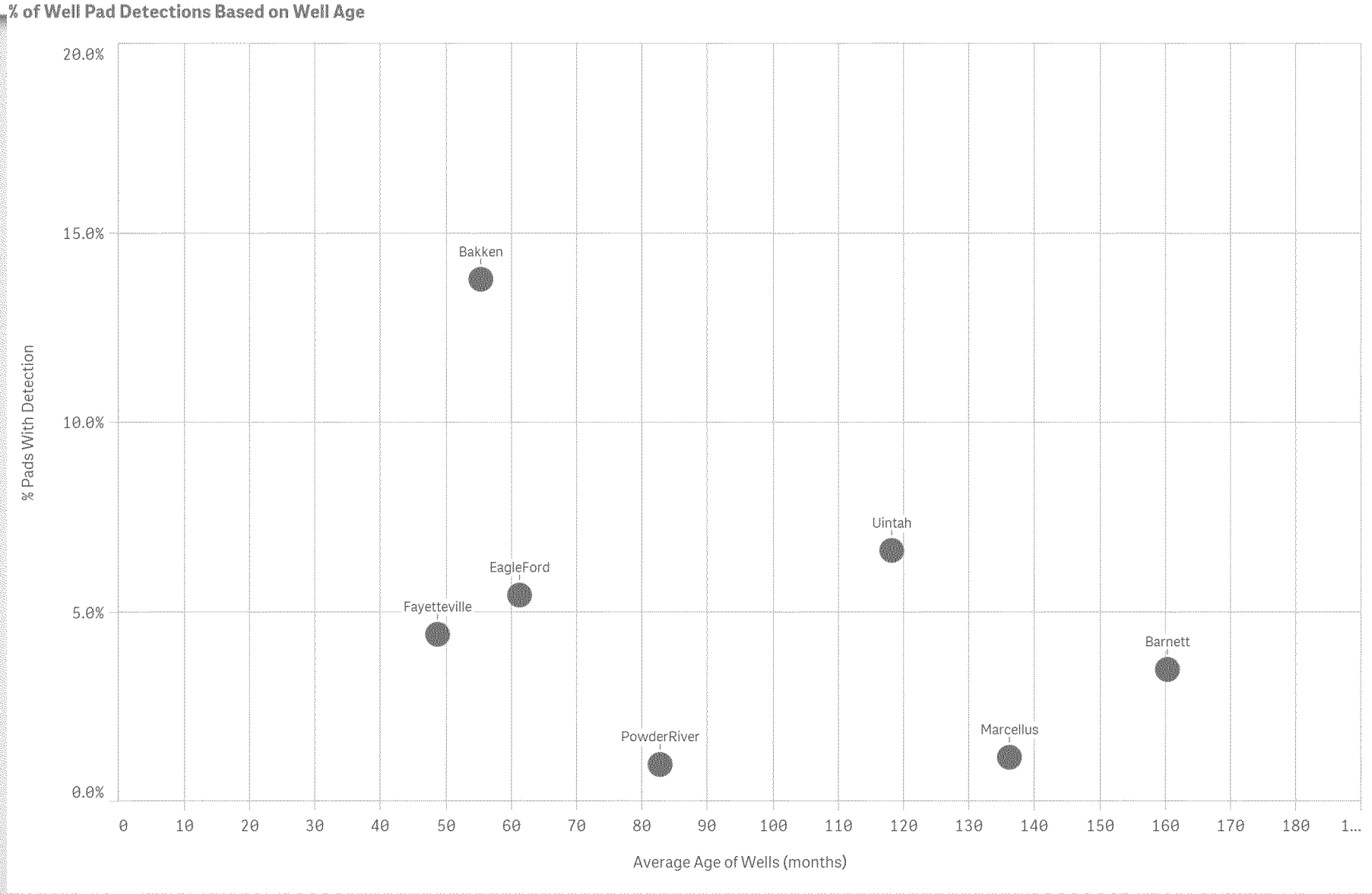
EDF Aerial IR Surveys



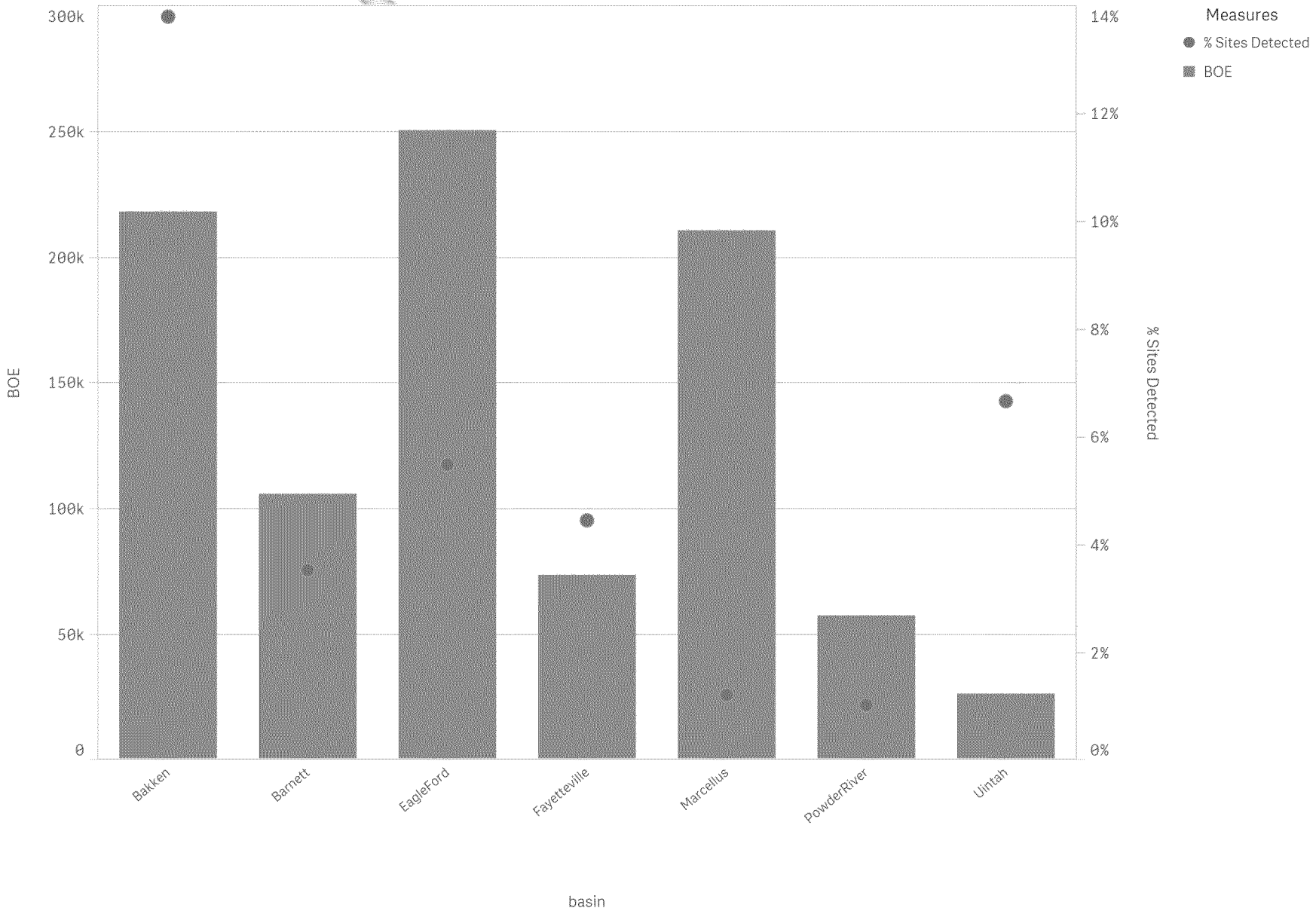
8,220 wells Surveyed over ~2,600 sq. miles in 7 Basins:

1) Bakken
2) Barnett
3) Eagle Ford
4) Fayetteville
5) Marcellus
6) Powder River
7) Uinta

% of Wellpad Detections vs. Age



% Wellpad Detections vs. Production



EDF Aerial IR Surveys – Key Take-Aways

Leak detection

- Stochastic processes dominate the occurrence of high emissions

Compliance

- Over 90% of ~500 detected sources from tank vents and thief hatches

- Many correlations statistically significant, but none strong ($r \leq 0.28$) demonstrating the dominance of random processes
  - # detected sources from both tank vents and tank hatches was most strongly correlated with pad oil production ($r = 0.24$ and 0.19, respectively)
  - Non-tank emission sources had almost no relationship with well pad parameters

Project Plan

- Occur in 2016 before winter and potential reservation-specific FIP or BLM Waste Prevention (F&V) regs

- Fly-over with IR camera survey
  - 15 days, 29 "grids", **$105k**
  - Cover ~4800 sites (~44% of oil & gas wells)
  - Representative by Operator, age, production volume, well type (incl. abandoned)
  - Cover >50% of compressor stations and gas plants

- Ground-based IR camera survey
  - 24 days, 1 "grid", $26k
  - Cover ~165 sites
  - For same coverage as fly-over: ~700 days, **$760k**